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Susceptibility of microorganism to selected medicinal plants in Bangladesh

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PEER REVIEW

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Comments

This is an appreciated research in which authors have tried their best to demonstrate antimicrobial activities of selected medicinal plants in Bangladesh. Therefore, the findings of this study will encourage people to use medicinal plants, leaving synthetic medication as well as the researchers to develop better drugs against microbial infections in near future.
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ABSTRACT

Objective: To analyze *in-vitro* antimicrobial activities of some ethno-pharmacologically significant medicinal plants (methanol extract) against the pathogenic microorganisms (*Escherichia coli*, *Salmonella* spp., *Bacillus cereus*, *Staphylococcus aureus*, *Aspergillus niger* and *Candida albicans*).

Methods: The disc diffusion method was applied for antibacterial test and the poisoned food technique was applied for antifungal test.

Results: The methanol extract of *Terminalia chebula* (bark), *Phyllanthus acidus* (fruits), *Sarcochlamys pulcherrima* (leaves) and *Abelmoschus esculentus* (fruits) had significant *in vitro* antibacterial activity angainst the entire test samples in comparison to standard drug ciprofloxacin. Most of the plant extracts showed low activity against Gram negative bacteria while potential activity against Gram positive bacteria. The antifungal activities of methanol extracts of these plants and standard drug griseofulvin were determined against two pathogenic fungi, and *Polygonum lapathifolium* (leaves) and *Cinnamomum tamala* (leaves) showed maximum activity, while *Erioglossum rubiginosum* (leaves) showed no antifungal activity.

Conclusions: Further chemical and pharmacological investigations are required to identify and isolate chemical constituents responsible for these potential bioactivities and thus to determine their full spectrum of efficacy.

KEYWORDS

Susceptibility, Zone of inhibition, Percentage of inhibition, Antibacterial activity, Antifungal activity

1. Introduction

Microorganisms (*i.e.* bacteria, fungi and viruses) cause serious human and animal infections in tropical and subtropical countries and are the leading cause of death throughout the world. Antibiotic resistance has become a worldwide apprehension[1]. The clinical effectiveness of many surviving synthetic antibiotics is being vulnerable by the advent of multidrug-resistant pathogens[1]. In recent years, multiple drug resistance in human pathogenic microorganisms has been established due to unselective use of synthetic antimicrobial drugs[2]. Resistance is a capability of a microorganism by which microorganism

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can still alive under antibiotic and antifungal therapy. The problem of microbial resistance is growing and the outlook for the use of antimicrobial drugs in the future is still uncertain. Since most of the antibiotic and antifungal drugs are chemically synthesized or semi synthesized, resistance is not only the major problem, and adverse effects also play an important role in causing other serious diseases in human and animal (*e.g.* allergy, immune suppression, and hypersensitivity)[3].

Data from WHO illustrate that 70%-80% of the world's population use herbal medicine as alternative medicine[4]. Interest in plant-derived drugs has been increasing, mainly due to the current extensive belief that "green medicine" is safer and more dependable than costly synthetic drugs[5]. Natural and herbal products provide unlimited opportunities for new drug leads because of the unmatched availability of chemical diversity. Over the past two decades, there has been an increasing interest in the investigation of natural materials as sources of new antibacterial agents[6]. Many reports have revealed the effectiveness of natural plants against microorganisms; as a result, plants are one of the foundations for modern medicine to attain new principles[7]. Even though numbers of plant-derived antibiotics are being identified, the scientific evaluations of plant derived antibiotics still remain an area of intensive investigation[8]. Until natural products have been approved as new antibacterial drugs, there is an urgent need to identify novel substances active towards highly resistant pathogens[9]. The continuing development of resistance to existing antibacterial agents and the shortage of good antifungal agents provoke this effort toward innovation[10]. Therefore, researchers are increasingly turning their attention to folk medicine, looking for new leads to develop better drugs against microbial infections[11].

It is evident that herbal antibacterial and antifungal drug has great potential to complement synthetic medicines; it is therefore necessary to increase the production of drug from both plants and chemical synthesis. Bangladesh is home to over 5 000 medicinal plant species and their use for medicinal purposes is remarkable[12]. Bangladesh is one of the richest countries in the world regarding genetic resources of medicinal plants. The country exhibits diversity in terms of topography and climate, which has a bearing on its vegetation and floristic composition. Moreover, the agro-climatic conditions enable introduction and domestication of plant varieties[1]. In recent years, medicinal plants previously with unknown pharmacological activities have been broadly studied as a rich source of medicinal agents in Bangladesh[13]. It is expected that phytomedicines with adequate antibacterial efficacy could be used for the treatment of microbial infections[14]. However, there is still lack of data on the susceptibility of microbes to commonly used medicinal plant extracts in Bangladesh.

Against the above background, the present study was undertaken to evaluate the susceptibility of selected bacterial and fungal pathogens to medicinal plant extracts commonly used as herbal medicines. It is hoped that the findings of the study will promote the use of herbal products. The ultimate goal of the present study is to establish appropriate and efficient herbal remedies that could effectively inhibit growth of pathogens.

2. Materials and methods

2.1. Collection and identification of plant material

Fresh plant/ plant parts were collected based on ethno-pharmacological importance from Noakhali, Dhaka and Cox's Bazar district, Bangladesh. The plants and the parts screened, along with their taxonomic identity, local name, family and therapeutic uses, are given in Table 1.

Table 1

Ethnobotanical information of some traditionally used Bangladeshi medicinal plant species selected for antimicrobial activity.

Plant name	Accession number	Local name	Family	Therapeutic use	Reference
P. lapathifolium	DACB 37924	Bishkatali	Polygonaceae	Anthelmintic, antiemetic, cytotoxic	[15]
S. violaceum	DACB 37751	Tit Begun	Solanaceae	Anthelmintic, antioxidant, antimicrobial, anti-inflammatory, cytotoxic	[16]
M. charantia	DACB 37656	Korola	Cucurbitaceae	Hypoglycemic, antioxidant, anti-fungal, anti-malarial, thrombolytic	[17]
A. bilimbi	DACB 34207	Bilimbi	Oxalidaceae	Antibacterial, antioxidant, cytotoxic	[18,19]
C. tamala	DACB 39290	Tejpata	Lauraceae	Antimicrobial, antidiarrhoeal, cytotoxic	[20]
E. officinalis	DACB 37912	Amalaki	Euphorbiaceae	Anti-inflammatory, antioxidant, anticancer	[21]
J. gossipifolia	DACB 35937	Jatropha	Euphorbiaceae	Anti-infertility, anti-inflammatory, antidiarrhoeal, analgesic	[22,23]
L. monopetala	DACB 39559	Mendapata	Lauraceae	Antimicrobial, anti-inflammatory, thrombolytic	[24]
E. fluctuans	DACB 37925	Helencha	Asteraceae	Antioxidant, thrombolytic, anthelmintic, analgesic, CNS depressant, antidiarrheal, antimicrobial, cytotoxic	[25-30]
D. quercifolia	DACB 35489	Pankhiraj, Pankha	Drynariaceae	Anthelmintic, antibacterial, antioxidant, cytotoxic, thrombolytic	[31]
T. chebula	DACB 37909	Maritaki, Haritaki	Combretaceae	Antiemetic, antidiarroheal, antioxidant, anti-diabetic, antimicrobial, cytotoxic	[32]
A. conyzoides	DACB 39526	Dochunti, Fulkuri	Asteraceae	Antioxidant, anti-inflammatory, analgesic, antipyretic, antiseptic	[33]
M. cordifolia	DACB 34527	Guaco	Asteraceae	Antioxidant, anti-inflammatory, analgesic, antipyretic, preventing sexually transmitted diseases	[34]
C. bonplandianum	DACB 37658	Bon Tulshi	Euphorbiaceae	Antioxidant, cytotoxic	[35]
P. acidus	DACB 34509	Arboroi, Harbori	Phyllanthaceae	Anti-inflammatory, anti-nociceptive, antioxidant, antidiarrheal, antimicrobial, cytotoxic	[36-38]
A. polystachya	DACB 37658	Pitraj	Meliaceae	Cytotoxic, anthelmintic, antimicrobial, thrombolytic, antioxidant	[39]
A. esculentus	DACB 2435	Okra, Bendi	Malvaceae	Antibacterial, antioxidant, antidiabetic, CNS depressant, analgesic	[40-42]
S. pulcherrima	DACB 35871	Jangaillya shak	Urticaceae	Thrombolytic	[43]
C. viscosum	DACB 35979	Vant, Ghetu	Lamiaceae	Antiseptic, antimicrobial, anti-inflammatory, antipyretic	[44]
E. rubiginosum	DACB 38566	Kalayo	Sapindaceae	Membrane stabilizers, antimicrobial, antioxidant, thrombolytic, cytotoxic, CNS depressant	[45,46]

CNS: Central nervous system. *P. lapathifolium*: *Polygonum lapathifolium*; *S. violaceum*: *Solanum violaceum*; *M. charantia*: *Momormdica charantia*; *A. bilimbi*: *Averrhoa bilimbi*; *C. tamala*: *Cinnamomum tamala*; *E. officinalis*: *Emblica officinalis*; *J. gossipifolia*: *Jatropha gossipifolia*; *L. monopetala*: *Litsea monopetala*; *E. fluctuans*: *Enhydra fluctuans*; *D. quercifolia*: *Drynaria quercifolia*; *T. chebula*: *Terminalia chebula*; *A. conyzoides*: *Ageratum conyzoides*; *M. cordifolia*: *Mikania cordifolia*; *C. bonplandianum*: *Croton bonplandianum*; *P. acidus*: *Phyllanthus acidus*; *A. polystachya*: *Aphanamixis polystachya*; *A. esculentus*: *Abelmoschus esculentus*; *S. pulcherrima*: *Sarcochlamys pulcherrima*; *C. viscosum*: *Clerodendrum viscosum*; *E. rubiginosum*: *Erioglossum rubiginosum*.